The Madras Agricultural Journal

Vol. XLI — JUNE 1954 — No. 6

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Vol. XLI | June 1954 | No. 6

Editorial

In a plea for increased food production for a country like India with its varying soil and climatological conditions investigations into the possibilities of double cropping should occupy a premier position. If, with a little additional effort more food could be produced from the same land it would be criminal to have neglected that aspect. The question then arises how far and how best the present arable lands could be put under double cropping and whether all such land that could profitably be brought under this condition has been done so. In a comprehensive survey on an all India basis the I. C. A. R. has published a useful, short review on this subject (Rev. No. 8, 1953). In this review it has been found that India offers a large scope for the practice of double cropping especially in areas enjoying assured irrigation facilities or rainfall. Of the three main cereal crops it is only in wheat and rice lands that the fields are left without any cropping for a long period since these are mostly single crop areas. It is here that suggestion is put forward for cropping the land with suitable soil enriching and also food crops like pulses etc. Though the practice of taking an interim crop is found here and there it has not run into an organized and planned practice. In the millet areas on the other hand the normal practice of mixed cropping keeps the land under cover crops long after the main cereal is off the field. The review runs under several headings: (1) soil conditions, (2) summer catch and cover crops, (3) winter catch crop, (4) double cropping practices, (5) irrigation and summer crop and (6) manuring for double cropping. The review summarises the achievements that have already been obtained and the agricultural practices throughout the length and breadth of India under different agroclimatological conditions. Horsegram is found to be the most favourite winter catch crop in many places. Under padi land conditions as a winter catch crop peas could be tried with advantage as this yields more than bengal gram and does not suffer from wilt and other diseases. The double cropping

systems followed in different parts of India are rice-rice, ragi-ragi, rice-pulses, bajri (cumbu)-bajri, bajri-pluses, bajri-wheat, sorghum (cholam)-pulses, wheat-maize, maize-pulse, or clover, groundnut-wheat or barley, groundnut-ragi and other millets, gingelly-ragi or sorghum and cholam-linseed. Different short duration cultures have been obtained by the State Agricultural Departments to suit these systems of double cropping. Otherwise the practice is not in vogue where long periods of drought intervene between one crop and the next. Where conditions are favourable manuring is found to be essential. Attention to checking of soil erosion is also emphasised. Elsewhere in this issue is published an article on food production and requiremet. In this review it is shown how though Madras State has just attained sufficiency in food at 'adequate level' it is still on marginal side and it is not at 'optimal level'. The food balance is seriously lacking in serveral important ingredients. It is usually over weighted with carbohydrates and very much wanting in others. It is therefore fit that as far as possible these necessary items are also made available in sufficient quantities so as to be available to all. Careful cropping plan to utilize the land between two main crops may lead to solve this problem partially.

Manurial Trials with Ammonium Sulphate on Ryots' Fields in the Madras State

By

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Various experiments on rice or paddy at many of the research stations have shown that ammonium sulphate as a manure for paddy has been efficacious and the increases obtained varied from 10 to 30 per cent depending upon the locality and the dosages of ammonium sulphate. Most of the experiments have also shown that the best results with ammonium sulphate are obtained when it is applied some time after planting, i. e. 3 to 4 weeks in the case of short duration varieties and 4 to 6 weeks in the case of medium and long duration rices. With the pressing need for increasing the production of rice, the quickest and surest way would appear to be the use of this manure to the rice crop where irrigation facilities exist. To estimate exactly what percentage of increase of yield ammonium sulphate would give and also to serve as demonstration to other ryots, experiments were started with the application of ammonium sulphate on ryots fields in this State.

Location of Experiments: The experiments were conducted in the several paddy growing taluks in the districts where there are more or less secure irrigation facilities in the official year 1950—'51 as shown below:

District	Taluks and number of experiments (within brackets) in each taluk	Total number of experiments in the district
East Godavary	Peddapuram (9), Pithapuram (7), Rajamundry (6), Amalapuram (8), Ramachandrapuram (6), Kothapeta (7), Rajole (8), Kakinada (6), Tuni (8)	65
West Godavary	Elluru (6), Tadepalligudem (8), Tanuku (8), Bhimavaram (8), Kovvur (5), Narasapur (8)	43
Krishna	Masula (8), Avanigadda (8), Bezwada (5), Gudivada (7), Kaikalur (8)	36
Guntur	Repalle (8)	8
Nellore	Nellore (8), Kovur (8)	16
Madura	Madura (7), Melur (8) Uttamapalayam (3), Periakulam (1)	19
Tanjore	Kumbakonam (8), Pappanasam (7) Nannilam (8), Sirkali (9) Tanjore (7), Kodavasal (3)	42
Pattukottai	Pattukottai (7), Tiruturaipoondi (8)	15
Tiruchirappalli	Lalgudi (8), Tiruchirappalli (8), Kulitalai (8), Karur (4), Musiri (7)	35
Tirunelveli	Tirunelveli (8), Ambasamudram (8) Srivaikuntam, (8), Tiruchendoor (4)	28

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The actual centres of the experiment in each taluk were selected by the District Agricultural Officers concerned. As the object of the experiment was to assess the possible increased yield resulting from the use of ammonium sulphate and not the gross yields, strict randomisation was not adopted.

Treatments: (i) It was thought adequate if two stages of application after planting are considered. This is borne out from a knowledge of a method of nutrition of the paddy plant. For the short duration paddy, 3 weeks and 5 weeks after transplanting were the stages of application and for medium and long duration varieties (Sarva and Samba) the times of application were 4 and 6 weeks after planting.

(ii) Two dosages of ammonium sulphate, i. e. 100 lb. and 150 lb. per acre were included in the experiment. The former is one that is being recommended at present and 150 lb., the higher dosage for such people as could afford it if the increased yield obtained is encouraging. Also two times of application, 3 weeks and 5 weeks for short duration and 4 weeks and 6 weeks for long duration were adopted. The intended trials on the short duration Kuruvai crop could not be laid out as the season for application of the manures was long past by the time the scheme was sanctioned.

Size of the experimental plot: As the soil heterogenety in most of the cultivators' fields is larger than on a research station, 10 cent plots were fixed up for each treatment from which five cents were harvested for yield purposes.

Growth and harvests: The progress of the experiments was now and then studied and special features were noted in the experiment area which might vitiate the results. Such of the plots, which showed excessive variation due to differential rat attack, weediness, want of timely irrigations, etc., were eliminated from the computation of results. All data on the basal dressing of manure, if any, that was applied, the date of planting, etc., and the variety used were gathered. The weights of the produce, both grain and straw from the 5 cents of each treatment were gathered by the Agricultural Demonstrators who were in direct charge of the experiments and these results were analysed by the Paddy Specialist.

Analysis of results: As the original idea of the experiment was to gather the increase of yield that ammonium sulphate would confer under conditions obtaining in the ryots' fields, the yields were recalculated as percentages of the controls, under each time of application and these percentages were statistically analysed. As in most cases two separate fields were taken for each time of application of the manure, these fields were taken as separate series and the control in each of them was taken for that field for calculation of percentages.

It may be mentioned that in some experiments the straw weights were recorded when the straw is totally green resulting in a very high yield. It was therefore found not possible to get at the actual yields of straw. It was found that by the application of ammonium sulphate, straw yield increased from 8 to 30 per cent. In some cases, the weights were of the wet straw. These increased yields in straw were however, not taken into consideration for commenting the economics of the treatments. This extra gain could be set off against the extra labour that would be involved in the spacing of the manure and the additional harvesting charges due to the increased crop production. Only the average percentage of increase of straw in each district is given in statement III.

It was found that the 6 weeks application followed more or less the trend of the results of the 4 weeks application. Hence only the grain yields of the 4 weeks application were statistically analysed taking the villages as replications.

In most of the taluks there were 7 to 8 experiments under each time of application and these were taken as separate replications and the results were analysed statistically for each taluk as one stratum. It was found that the general effect of ammonium sulphate application was significant by the 'Z' test at all taluks except Tirunelveli and Kodavasal. The results of the analysis of grain yields are set out in statement I talukwar. The average increase for the district was weighted where there are different number of plots in the taluks.

The following are brief comments districtwise on the results of the experiment:

East Godavary: Application of 100 lb. of ammonium sulphate (20 lb. of Nitrogen), 4 weeks after planting resulted in increases in the several taluks varying from 6·9 percent in Pitapuram to 21 percent in Tuni. The average increase for the district is 13 percent over control. By an application of 150 lb. of ammonium sulphate (to give about 30 lb. N) there was an increase of 18 percent over control. Though it may not be very correct to estimate from these small number of trials the actual increased production, we may at a safe estimate reckon the increase at 300 lb. of grain from 100 lb. ammonium sulphate application and 400 lb. for 150 lb. application. It may be pointed out that the control plots yield about 2500 lb. per acre including the tank-fed areas of Tuni and Pithapuram. Thus, though the increased percentage is about 15 and 18 by the applications of 100 lb. and 150 lb. of ammonium sulphate, the increased production is fairly high. Most of the ryots in this district manure their lands either with cattle manure or some leaf. It may be mentioned that application of ammonium sulphate 6 weeks after planting has secured slightly less increases and hence for this district application of ammonium sulphate 30 days after planting is the best stage.

West Godavary: In most of the villages, the treatments included application of 80 to 100 lb. of ammonium sulphate and hence they were analysed with no ammonium sulphate and ammonium sulphate as a paired set. The increase of grain by application of ammonium sulphate varied from 12 to 35 percent and the average yield increases in the district was found to be 23·7 percent with a net profit of Rs. 54/- per acre. Most of the areas here are also well cultivated. The application of the artificial manures gave good response even in saline areas. It was also more efficacious in sandy and loamy types than on the stiff black clay which usually support a good paddy crop.

Krishna: In this district comparing the 150 lb. and 100 lb. applications it was found that ammonium sulphate at 150 lb. gave slightly higher yields within the critical difference. Application of 100 lb. of ammonium sulphate gave 10 to 32 percent increased yields over 'no ammonium sulphate' control, the average for the district working out to 20·4 percent, equivalent to 460 lb. of grain with a profit of Rs. 41/- per acre. It was found that application of manure four weeks after planting was better than application at six weeks after planting.

Guntur: The experiments were laid out only in one taluk, Repalle, as in the other taluk, Tenali, planting was done much ahead and the season for application of ammonium sulphate was over by the time the scheme could start. It was found in this taluk that 150 lb. ammonium sulphate had given a significantly higher yield than 100 lb. application. Application of 150 lb. sulphate gave 25 percent increase in yield equivalent to 600 lb. while 100 lb. gave 15 percent increase corresponding to 350 lb. grain. The soils in this taluk are loamy to sandy and the fertility is not as high as in other parts of the Krishna delta. Thus for this taluk, 150 lb. dosage of ammonium sulphate may be recommended for application of the sulphate is better done at four weeks after planting than otherwise.

Nellore: In the two delta tuluks, Kovur and Nellore, the experiments were conducted as in other East Coast districts. The application of ammonium sulphate 4 weeks after planting was somewhat superior to '6 weeks after planting' though the difference is only 4 percent. Application of 150 lb. gave increases ranging from 0 to 80 percent and 100 lb. application from 4 to 71 percent (the highest percentage being in the poorer types of soil near the coast). The average increase for 150 lb. application was 21 percent equivalent to 420 lb. of grain while 100 lb. application gave 14 percent increase, equivalent to 270 lb. of grain. In 8 of the 16 villages 150 lb. application gave higher yield than 100 lb. application. The profits were Rs. 17/- for 100 lb. application and Rs. 28/- for 150 lb. application.

Southern districts: Tanjore: The trials were conducted in seven taluks. Due to the very high bunds in the delta it was generally reported

that there was some amount of rat damage in the several experiments and this fact does naturally vitiate the results considerably. It is difficult under the ryots' conditions to estimate such loss and allow for it in the computation. It was also reported that some fields suffered for want of water at the last stages and the yields from them are therefore generally lower than these with fuller supplies. It was also seen that in many of the plots the ryots did not apply any basal dressing of organic matter. This is another feature which sets a limit to the action of ammonium sulphate. Even with the limitations, however, it was found that applications of ammonium sulphate at 100 lb. at 4 weeks after planting secured an increase varying from 7 per cent in Kodavasal (200 lb.) to 26 per cent in Tanjore (450 lb.) with an average increase of 13·5 per cent (270 lb.) over no ammonium sulphate treatment. With 150 lb. application the increases varied from 13 per cent to 36 per cent (620 lb.) over no ammonium sulphate with an average of 23 per cent (460 lb.). Application of ammonium sulphate six weeks after planting did not show much advantage and as a matter of fact 150 lb., four weeks after planting was found to be somewhat better. Valuing the grain and manure at the present rates it was found that 100 lb. ammonium sulphate application four weeks after planting gave Rs. 17/- profit while 150 lb. application secured Rs. 33/-.

Pattukkottai: The new delta in this tract included a large area which has been recently reclaimed. The cultivation here is generally poor. As can be seen from statement I the acre yield of the control plot (where no ammonium sulphate is applied) is only 1630 lb. It was found that 100 lb. of ammonium sulphate applied four weeks after planting gave 12·9 per cent increase (equivalent to 210 lb.) and 150 lb. gave 16·6 per cent increase equivalent to 270 lb.) of grain working out to a profit of Rs. 10/- and Rs. 9/- for the two applications respectively. Ammonium sulphate applied six weeks after planting gave less yields than the 'four weeks application'.

Tiruchirapalli: This is one of the rich areas of the State and the average acre yield of the control itself is as high as 3010 lb. Usually a crop of green manure is raised for the samba areas. One hundred pounds of ammonium sulphate applied four weeks after planting gave an increase of 10·9 per cent (equal to 330 lb.) with a net gain of about Rs. 25/- while 150 lb. application gave a 15 per cent (equal to 450 lb.) with a net gain of Rs. 32/- per acre.

It was found in this district ammonium sulphate applied six weeks after planting gave higher percentage of increase than the application four weeks after planting. 100 lb. of ammonium sulphate when applied six weeks after planting secured 21·3 per cent increase (630 lb.) with a

net gain of about Rs. 32/-. There was no difference in yield between 100 lb. and 150 lb. when applied six weeks after planting.

Madura: The rice area of this district especially that under the Periyar Project is one of the most fertile zones of the State and high yields of rice are recorded. The ryots are usually very painstaking and try to manure the lands with some manure or other. The control plot in this district gave an average acre yield of 2610 lb. It was found that the application of ammonium sulphate four weeks after planting was superior to that applied six weeks after planting. Application of 100 lb. of ammonium sulphate four weeks after planting secured an increased yield of 22·9 per cent over control (equivalent to 600 lb. per acre) with a net gain of Rs. 59/- per acre while, the application of 150 lb. of ammonium sulphate secured a substantial increase of 1100 lb. per acre, i. e. 42 per cent over control, the net gain working out to Rs. 113/-. This might appear somewhat high but considering the soils which are well drained, with good irrigation facilities, the yields might be taken to be normal for the tract.

Tirunelveli: The Tamraparni basin consisting of about half a lakh of acres of double-croped wet land is one of the most fertile of rice zones usually met with. The kar crops give high average yields of 3500–4000 lb. per acre but the second crop harvest is usually not of this magnitude. It was reported that due to the failure of the North-east monsoon during 1950–'51 there was certain amount of drought in the second crop and consequently the yields were affected to some extent. The control (no sulphate) plots gave an average acre yield of 2520 lb. Application of ammonium sulphate of 100 lb. four weeks after planting gave increases varying from 5 to 20 per cent with an average of 12·3 per cent (equivalent to 310 lb.) working out to a net profit of Rs. 22/-. There were no differences in the efficacy of 100 lb. or 150 lb. of ammonium sulphate, the high dose giving a less economic return. It was also found in this district that the applicaiton of ammonium sulphate at six weeks after planting was better than four weeks; the 100 lb. application at six weeks gave a net return of Rs. 37/- and 150 lb. a net return of Rs. 25/-.

Conclusion: A perusal of the statement shows that in general, ammonium sulphate applied four weeks after planting at a dosage of 100 lb. is efficacious securing at least an increased yield of 259 lb. of grain per acre. In certain districts 100 lb. was quite optimum and efficacious as it gave as good and sometimes higher returns than 150 lb. As a general practice, 100 lb. of ammonium sulphate to be applied four weeks after planting over some basal dressing of organic matter, if it could be secured, may safely be recommended. If funds permit, 150 lb. of sulphate can also be applied but this may depend upon the inherent fertility of the field, the nature of soil, etc. This higher dosage is more effictive on lighter soils than on heavier types.

STATEMENT No. I.

Results of application of Ammonium sulphate on ryots' field four weeks after planting

District	Acre yield of control plot	100 lb. Ammonium sulphate			150 lb. Ammonium sulphate		
		Increase		Profit for acre	Increase		Profit for acre
		%	Grain in lb.	Rs. A. P.	%	Grain in lb.	Rs. A. P.
East Godavari ..	2520	13·1	330	25 1 0	17·9	450	31 9 0
West Godavari ..	2350	23·7	560	53 9 0	..	..	..
Krishna ..	2260	20·4	460	41 1 0	24·8	560	45 4 0
Guntur ..	2380	14·7	350	27 7 0	25·2	600	50 4 0
Nellore ..	2010	13·4	270	17 7 0	20·9	420	27 12 0
Tanjore ..	2000	13·5	270	17 7 0	23·0	460	32 12 0
Pattukottai ..	1630	12·9	210	9 13 0	16·6	270	9 0 0
Tiruchi ..	3010	10·9	330	24 13 0	15·0	450	31 8 0
Madura ..	2610	22·9	600	58 9 0	42·1	1100	112 12 0
Tirunelveli ..	2520	12·3	310	22 5 0	9·9	250	6 8 0

(1) Grain valued at 0—2—0 per lb. (2) Cost of ammonium sulphate at Rs. 16—7—0 per 100 lb.; Rs. 24—12—0 for 150 lb. (3) Value of straw not taken into consideration, for profit. (4) Includes super application also in some taluks.

STATEMENT No. II.

Results of application of Ammonium sulphate six weeks after planting

District	Yield of control	100 lb. Ammonium sulphate			150 lb. Ammonium sulphate		
		Increase		Net profit nearest to rupee	Increase		Net profit nearest to rupee
		Grain yield lb.	%		Grain yield lb.	%	
East Godavari ..	2240	280	12·5	19	340	15·2	18
Krishna ..	2220	310	14·0	22	430	19·4	29
Guntur ..	2220	250	12·6	15	540	24·3	43
Nellore ..	2140	240	11·2	14	360	16·8	20
Tanjore ..	1990	290	14·6	20	410	20·6	27
Pattukottai ..	1710	100	5·8	4	200	11·7	..
Tiruchi ..	2960	630	21·3	62	600	20·3	50
Madura ..	2640	430	16·3	37	690	26·2	65
Tirunelveli ..	2420	430	17·8	37	400	16·5	25

STATEMENT No. III.

Yield of straw in the several districts Ammonium sulphate applied four weeks after planting

District	Control	Ammonium sulphate	
		100 lb.	150 lb.
West Godavari ..		Not available	
Krishna ..		Not available	
Guntur ..	100	113	126·6
Nellore ..	100	116	124·0
Pattukottai ..	100	115·8	128·3
Tanjore ..	100	111·7	118·1
Tiruchirappalli ..	100	108·2	116·5
Madura ..	100	115·7	135·5
Tirunelveli ..	100	107·5	114·5

Drying of Sweet Potatoes and Preparation of Flour, Biscuits and Cakes

By

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Introduction: The sweet potato, (*Ipomoea batatas*), belonging to the family of Convolvulaceae, is a crop that has established itself very well in our country. In view of the increased interest in this crop as an article of diet, it is proposed in this paper to give simple directions in drying for storage and for the manufacture of flour products, such as biscuits, bread and cake.

The sweet potato is a plant of tropical America, its original home probably being the West Indies and Central America. Its cultivation is simple as it comes up in almost every kind of soil, though it makes its best growth on sandy or well drained soils. It is fairly well known that sweet potato forms an exceedingly nutritive food. It can be and is eaten raw, fried, roasted or boiled. But its usefulness when the tubers are sliced and dried in the sun and ground into flour and baked into bread, biscuit and cake is not so widely known. The sun dried chips converted into flour can be used in a variety of ways as an article of food. The sweet potato can also be preserved for a long time by a simple process of boiling the tubers, pressing the cooked tubers into cakes and drying in the sun.

Preparation of Sun Dried Chips: The tubers are washed well prior to slicing and scraped with a knife to remove the rind. The rind-free tubers are then sliced into chips of not more than quarter of an inch in thickness, spread over a cloth or on a clean cement floor and dried in the sun. Freshly cut slices are white in colour which change to cream yellow after two hours of drying. After about eight hours of drying, the slices are generally of dull white colour and crumble easily on pressing. In about 10 to 12 hours the drying is complete.

Flour: The sun dried chips are converted into flour by pounding in an iron or stone mortar and sieving. The flour prepared thus is creamy white in colour.

Chips: The sun-dried chips will be from $\frac{1}{3}$ to $\frac{1}{4}$ the weight of raw tubers taken for drying. The moisture content of the sundried chips will vary from 5 to 10 per cent depending upon the thickness of the slices. Sweet potato chips were prepared by the method mentioned above in a number of places and the samples were analysed in the laboratory for moisture, cooking quality and palatability. Cooking tests

were carried out by putting the chips in twice the volume of water and boiling. All the samples got cooked between 30 and 45 minutes. The results of cooking tests are given in the statement appended.

It may be seen that the taste of the cooked product was generally insipid. Hence, it is possible to use the dried chips for preparing the usual dishes after reconstituting them with water prior to cooking. They will be similar to any dehydrated vegetable in flavour and taste. The composition of sweet potato chips and flour is given below :

TABLE I
Analysis of Sweet Potato Chips and Flour (different samples)

Heads of Analysis	Desiccated chips %	Flour %
Moisture	10·46	11·33
Ether extractives	1·18	0·62
Crude fibre	1·91	2·21
Ash	3·04	1·84
Protein	4·50	1·94
Starch	46·22	50·03
Dextrose	18·55	10·75
Sucrose	10·93	19·61
Undetermined	3·21	1·67

(From Farmers' Bulletin No. 129. U. S. D. of Agri.)

Preparation of Bread, Biscuit and Cake with Sweet Potato Flour : Sweet potato flour can be used with maida flour for the manufacture of bread, biscuit and cake. For bread, equal parts of sweet potato flour may be used with maida. The bread so made is naturally a bit "heavy" and does not rise satisfactorily but when made into toast is palatable.

Biscuits can be prepared with sweet patato flour using upto 50 per cent of the total quantity of flour used without any detriment to quality. A recipe for the preparation is given below. For comparison, the amount of ingredients used for making ordinary biscuits is also given along with.

TABLE II

Ingredients Quantity—3 pounds of flour	Sweet potato biscuit	Ordinary biscuit
Sweet potato flour	24 oz.	..
Maida flour	24 „	48 oz.
Sugar	20 „	24 „
Butter	12 „	8 „
Ghee	4½ „	2¼ „
Baking powder	2 „	1 „
Flavouring etc.	Q. S.	Q. S.

From the above recipe it will be seen that sweet potato flour requires less sugar, but more of fat and baking powder. The biscuits have to be baked for a little while longer than for the ordinary biscuits. Slight darkening round the edges is likely to occur but it does not affect the quality of the product in any way. The flour requires to be kneaded for a longer time than the maida flour. Sweet potato biscuits prepared with about 50 per cent of the flour analyse the following: Moisture—0·79%; Protein—5·31%; Ether extractives—12·27%; Acid value—4·5 mgms./gram of fat.

These biscuits keep well and crisp for a long time. Biscuits prepared in a local bakery according to the above recipe and kept in

glass jars for ten months did not show any deterioration in taste or smell. They were found good even after one year. After storage for ten months the biscuits analysed as: Moisture 4·34%; Ether extractives 11·77%; Acid value 5·58% (mgm. KOH/gm. fat).

Preparation of Cakes: Good quality cakes can be prepared with sweet potato flour. The recipe given below may serve as a guide.

		Spice Cake	*Plain Cake*
Sweet potato flour		80 gm.	80 gm.
Maida flour		60 ,,	60 ,,
Sugar		140 ,,	140 ,,
Eggs		4 ,,	4 ,,
Butter		150 ,,	150 ,,
Milk		120 ,,	120 ,,
Baking power		15 ,,	15 ,,
Salt		One pinch	One pinch
Spices	Cinamon, Nutmeg, Cloves, Cardamom, Mace, Ginger	½ teaspoon	

When made each cake will weigh about a pound and a quarter.

Other ways of preserving sweet potatoes: 1. *Boiling and pressing:* The tubers are washed well to remove the adhering soil and placed in cold water and raised to a boil and kept boiling for about one hour cut into slices and dried. They can also be pressed into cake and dried in the sun for a day or two. The sun dried slices and cakes are brick hard and can be stored for over two years. When required for use they are soaked in water for a few hours, washed and cooked in the usual way. Some people claim that its taste is even better than the fresh ones. Nearly 50 per cent of the original weight of tubers are obtained by this method.

2. *Cooking and pressing through a vermicelli press:* The tubers are cooked and mashed with a little salt, pressed with a vermicelli press and dried in the sun. These can be stored in glass jars or tins for a long time. Wheat flour upto 25% can be included with the mashed tubers and given a short cooking before pressing. This product may be used in a variety of ways if one has the taste for it.

3. *Sweet potato starch and other product:* The sweet potato flour can be used for the preparation of starch, syrup and malt extracts and other useful and edible products.

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APPENDIX

No.	Samples from	Description of slices	Cooking quality, taste etc.	Moisture content of chips Per cent
1	Coimbatore Paddy Station	Brownish white thin slices rind intact	Insipid darkened on cooking	5·74
2	Kasargod	do.	Insipid	8·21
3	Palur	White thin slices	Inspid, darkened slightly	10·28
4	Ambasamudram	Brownish white rind intact	Inspid	9·10
5	Taliparamba	do.	do.	7·36
6	Gudiyattam	Grey white	No taste	6 04
7	Central Farm, Coimbatore	Thin white slices	Taste not bad	5·84
8	Pilicode	Brownish white	Insipid, darkened	7·95
9	Aduthurai	White big slices	Sweet, darkened	8·65
10	Tindivanam	White thin chips	Good—No colouration	5·77
11	Nileshwar	Light brown thin slices	Inspid—darkened	7·64
12	Pattukottai	White small thick slices	Insipid, turned brown	7·81
13	Koilpatti	Brownish thin slices	Insipid, darkened completely	9·05
14	Pattambi	Dull white big slices	Not palatable	7·14
15	Kallar	White thick slices	Insipid, darkened	8·10

Transmethylation and Methyl Synthesis

By

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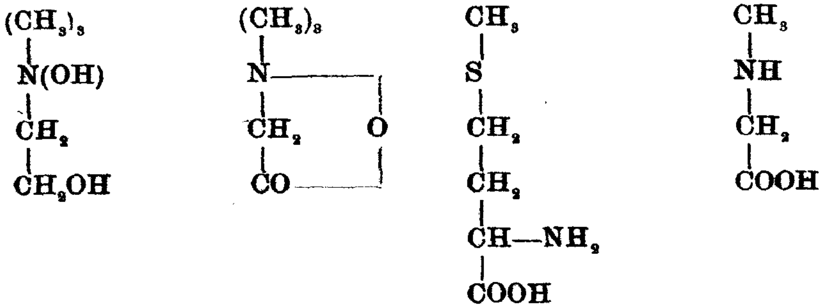
Introduction: Converging lines of research by nutritonists, chemists and clinicians lead to something entirely new in dietary requirements. Nutritional requirement had usually been in terms of whole complex compounds like the fats, carbohydrates or vitamins or in terms of simple elements like calcium, phosphorus etc. But for the first time and for probably the only unique instance of dietary requirement a group like the methyl group emerges out as an entity in Nutrition. Its discovery came about in the study of the diverse metabolic reactions of apparently totally unrelated compounds like casein, cysteine, methionine, choline, folic acid and recently Vitamin B_{12}.

Research on the amino acids on the one side, with the search for lipotropic substances on the other and lately the vitamin studies soon

focussed particular attention to this group as of such great importance in dietary requirements that as a result of numerous further studies since done, it has come to stay as an essential nutrient which has to be supplied to the animal for growth and metabolic function.

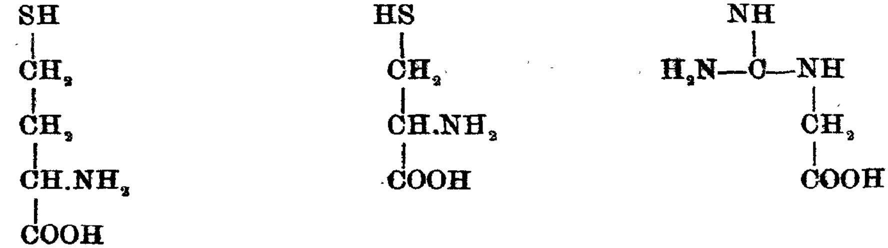
Source of Methyl Groups: This biologically important group of compound is found in a number of compounds which have been called methyl donors:

Choline — Betaine — Methionine — Sarcosine



These compounds have in common what is now known as "biologically labile methyl groups." By this is meant, that all methyl groups as a class are not all biologically useful unless they are found in specific compounds which allows the methyl group to be labile or transferable from them to what are now known as "methyl acceptors." Under the class of methyl acceptors or receptors the following could be mentioned:

Homocystine — Cysteine — Guanido acetic acid



These could take on methyl groups to form other biologically important compounds and this process of transferring methyl groups is known as transmethylation. Thus having defined the main terms involved in this study and the compounds that play a role in the nutrition of the methyl group a chronological review of the works that lead to the discovery of the group would make the picture complete.

Transmethylation: The phenomenon of transfer of methyl groups in biological systems came to be identified as a result of work done in almost entirely different fields as mentioned at the outset. These could be classified and discussed under: 1. Amino acid research; 2. Search for lipotropic and anti-lipotropic substances; 3. Vitamin research.

Amino Acid Research: Jackson and Block (17) working on diets low in casein for rats, found improved growth with the addition of methionine. Meanwhile to check some contrary findings of the time on fatty livers in relation to low casein and high casein diets, with and without the amino acid cystine, Tucker and Eckstein (28) set up an experiment to find the effect of added cystine in a low protein high fat diet. They found that cystine caused fatty livers when added to a high fat ration and that if the other sulfur containing amino acid viz., methionine was supplied this condition was prevented. Subsequently Rose and his associates (24) using purified amino acids showed that the addition of cystine alone to a diet deficient in both cystine and methionine was practically without any effect while on the other hand the incorporation of methionine in such a diet permitted rapid growth. Here was a poser which needed clarification, for, if the body needed sulfur containing amino acids to replenish the high content of sulfur in keratin proteins such as wool, hair, nails and hooves, in hormones such as insulin, etc., why should there be a difference in the growth response of methione and cystine, which were both sulfur containing amino acids?

A clue in the metabolism of the two sulfur containing amino acids was brought about by the work of Tarver and Schmidt, who fed methioine with labelled sulfur and isolated cystine with the labelled sulfur (29), thus showing the conversion of methionine to cystine. So, if the methionine could supplant the function of cystine, by synthesising it in *vivo*, it soon became evident that sulfur was not the key note for the dietary efficiency of methionine. It should therefore have something which cystine does not contain.

It was known at this time that the phospho-creatine is hydrolysed and re-synthesized during muscle action. Du Vigneaud et al (2, 10) showed by means of isotopic elements in D. L. Methionine that this amino acid contributes its methyl group for the conversion of guanido acetic acid to creatine. Thus, it became evident by 1941, that the methyl group was the important factor in the varied reactions obtained with the sulfur containing amino acids.

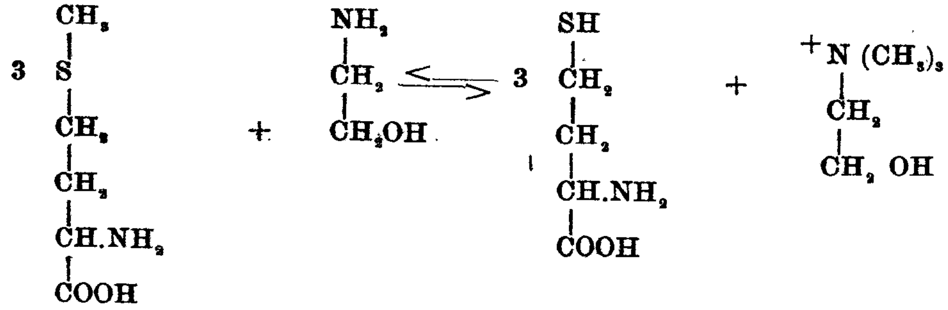
Search for Lipotropic and Anti-Lipotropic Substances: Side by side with the knowledge accumulating on amino acids, facts began to accumulate on substances which cause certain clinical symptoms in the animal system. These symptoms were invariably found to be (i) severe degeneration of liver cells concommittant with hemmorhage and intestinal inflamation (ii) degeneration occurring in the convoluted tubules in the kidneys (iii) deposition of fat in the liver.

Best, Hershey, and Huntsman (1, 2) had observed as early as 1932 that a deficiency of choline, betaine or methionine in the diet of young rats or dogs causes the deposition of fat in the liver. Du Vigneaud

(8) proposed homocystine as a possible intermediate in the conversion of methionine to cystine. This was found to cause fatty livers in the absence of methionine or choline, i. e., it was anti-lipotropic. Glynn, Hinswoth, and Neuberger (14) kept rats on a diet deficient in methionine and cystine and observed the development of massive hepatic necrosis which was prevented by methionine. Best and his co-workers (2) had reported that lecithin in the egg yolk was capable of preventing fatty livers and that the active lipotropic agent in lecithin is choline. Thus it became established that methionine and choline were lipotropic while homocystine and cystine were anti-lipotropic. Sulphur was not the incriminating factor in fatty livers for the sulphur containing compounds were ranged on either side. The answer to this enigma came from Du Vigneaud in 1942 and may be best put in his own words:

"This striking difference in lipotropic activity between homocystine and methionine was not inconsistent with the idea that the methyl group of methionine played an important role in the synthesis of choline by the body. Thus what was otherwise a perplexing similarity of action on the part of two apparently totally unrelated compounds such as methionine and choline, was, according to this hypothesis of transmethylation, readily understandable. The possession of a labile methyl group as the characteristic which choline and methionine had in common was not suspected as the explanation of this lipotropic activity until homocystine-methionine studies indicated a metabolic inter-relationship between choline and methionine" (11).

Thus transmethylation—the transfer of a methyl group from one compound to another—seemed to answer the apparent enigma. The scheme of transmethylation may then be pictured as follows:



Transmethylation has now been proved beyond doubt by a number of subsequent works, but the subject of methyl groups did not however become a closed chapter. It soon became interlaced with the subsequent studies of the B-Vitamins.

B-Vitamins and Methyl Groups: **Niacin:** Handler and Dann (16) found that 1% nicotinic acid or its amide caused toxic manifestations.

with concomittant loss of weight, which was counteracted by methionine but not by cystine or homocystine. Apparently nicotinic acid created a labile methyl group deficiency which was corrected by methyl donors.

Folic Acid and Vitamin B_{12}: Toennies, Bennett and Medes (30, 31) repeatedly came across conflicting results with rats in that they were able to obtain growth with methyl free homocystine containing diets. Analysis of the body showed an actual increase of methionine during the experimental period while the diet was free of labile methyl groups.

When a sulfasuxidine, along with eight B vitamins was given, the growth ceased (3). It seemed therefore that the sulfasuxidine had inhibited the formation of a methylation factor distinct from the essential growth vitamins. This lead them to conclude that "there may be vitamin factors of either dietary or intestinal origin, the presence of which may enable the animal to compensate for the absence of dietary methyl donors by biosynthetic means of its own or intestinal bacteria." When liver extract was added to such a methyl free homocystine diet in place of the B vitamins, growth was obtained

Patton and co-workers (22) noted in chicks that the growth promoting effects of methionine as a supplement to a corn soybean diet was no longer observed when "2% sardine meal was added to basal diet. Cunha et al (6) working with pigs found that Vitamin B_{12} and APF were similar from the standpoint that methionine did not help in growth when fed in addition to either of them and that methionine improved growth of pigs only in the absence of an APF supplement. Shive (27) found that methionine and vitamin B_{12} could function interchangeably in enabling growth of *Escherchia coli* to take place on a medium containing sulfanilamide. In rats, Schaeffer and coworkers (26) demonstrated the protection afforded by B_{12} against kidney damage produced by a diet low in choline and methionine. Drill (7) showed the lipotropic effect of B_{12} in rats. Gills and Norris (15) find that the inclusion of a source of APF in their basal diet obviated the need for supplementary methylating compounds for chicks. All these studies seemed to indicate a definite relationship between methylating compounds and B_{12}.

Next came the observations on folic acid by Bennett (4) which partly cleared up the exact relationship. She reported that folic acid in the absence of sulfasuxidine promoted growth on a methyl-donor-free-diet, but there were some cases of growth in the presence of sulfasuxidine also. This indication of the rat's ability to utilise homocystine even though the intestinal folic acid synthesis had been checked by the sulfa drug was interpreted by her to mean that folic acid was not the only factor involved and that some other factor probably vitamin B_{12}, by being stored in varying degrees in the pre-experimental period might probably

be involved. In a subsequent experiment (5) she reported that B_{12} plus folic acid gave an effect similar to that obtained earlier with crude liver extracts with rat's on the methyl-free-homocystine diet.

Patrick (23) found in chicks that methionine and B_{12} gave the same growth response and when both were added the growth response was no greater than either. Jukes, Stokstad and Broquist (18) report B_{12} as involved in both the methionine and choline requirement of chicks.

So, from all these it was evident that vitamin B_{12} was somehow concerned in the synthesis of methyl groups in the animal system. Whether these were formed in the enzyme system of the tissues or effected through the intestinal bacteria was the next aspect to be investigated. Oginsky (21) using rat liver homogenate found that liver from B_{12} deficient rats exhibit a lower ability to form methionine from homocystine and either choline or betaine, as compared with those from animals dosed with Vitamin B_{12}. In vitro activation of the methionine forming system by addition of solutions of crystalline Vitamin B_{12} (Merck), proved unsuccessful. Hence though B_{12} is concerned in vivo synthesis of methyl groups, its mechanism is still not clear. That the biological synthesis of methyl groups in the presence of B_{12} was only by tissues was shown by the use of germ free animals (12).

Vitamin B_{12} and folic acid therefore seems to bear some relationship to labile methyl metabolism and its synthesis in the animal system.

The source of the carbon from which the synthesised methyl group is obtained has been studied in recent times and though the reports are conflicting, it may be said to be probably derived from glycine or serine.

Sakami and associates (25) report the incorporation of the methyl group of labelled acetone and of formate into the methionine and choline methyl groups. While Jonsson and Mesher (19) fed serine labelled with C^{14} in beta position and isolated choline with radio activity in the methyl group and believes there is reason to state that pteroylglutamic acid and Vitamin B_{12} may be involved in these transformations.

Weissbach et al (32) reports that L-serine is not only a source of ethanol amine portion of the choline but also of its methyl carbon atoms.

Elwyn and Sprinson (13) showed the extensive synthesis of methyl group of thymine in the adult rat. The activity of the methyl carbon atom of thymine following the administration of beta labelled serine accounted for 90% of the total activity of the molecule and was about 2·5 times that of the methyl groups of choline. The authors suggest that the reported role of folic acid and Vitamin B_{12} in the synthesis of methyl groups and the common origin of the methyl groups of choline

and thymine and the 2 and 8 positions of uric acid offers an explanation for the known replaceability of folic acid or Vitamin B_{12} by thymine in certain deficient micro-organisms.

These results undoubtly show that synthesis of the methyl group is possible in the animal system and need not be an essential supplement, provided fairly high levels of Vitamin B_{12} and folic acid are furnished.

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Food Production and Requirements of the Madras State

Communicated by

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The food problem of a State is essentially one of feeding its population, firstly, to satisfy the primary needs of hunger and secondly, to ensure the supply of the various food constituents in adequate amounts to prevent demonstrable deficiency diseases. To attain these two important objects, reliance is usually placed on internal food production; whenever gaps or deficits are detected, they are attempted to be overcome by suitable imports, depending on the availability and willingness of food surplus States to export, and the financial resources of the importing States. There is, of late, a growing tendency, almost universal, to gear up agricultural production to self-sufficiency levels and to minimize as far as possible, if not to completely eliminate, food imports. The levels at which self-sufficiency may be attained cannot be stated in absolute or well-defined terms. Food needs for self-sufficiency at 'optimum levels', the ideal to be kept in view in formulating food production plans, would obviously differ from those needed for self-sufficiency at 'adequate levels'. It is well to remember in this connection that chronically under-fed people have impaired, and sometimes depraved, appetite and are almost insensible to their lack of food. But, they do not function normally, let alone function at their best; every attempt should be made to provide them with sufficient and wholesome food. In these endeavours, it is essential to know the quantum of food production in the State and to equate it in relation to the nutritive requirements of her population.

Figures of food production in a State can be ascertained by one of the following means: (1) ascertaining the average food consumption of an individual, determined through detailed diet surveys carried out on a large segment of the population representing the various cross-sections, and multiplying it by the total number of people in the State; (2) by pooling the various production figures put out by government agricultural departments, and (3) by a knowledge of the extent of cultivated land under the various food crops and of their normal yields. Of these three methods, the first is very laborious and time-consuming and yet not capable of yielding even a reasonably reliable estimate. The second process may be fairly trustworthy and may give satisfactory data in

* The "Madras State" here refers to the composite State as it existed before the 1st October 1953, when the partition of the Andhra State and cession of a major portion of the Bellary district to the Mysore State took place.

normal times. But in periods of relative shortage, with consequential governmental controls and procurements, there is likely to be a tendency on the part of the producers to underestimate and deliberately suppress their production figures for major items of foodstuffs like cereals and pulses, while production figures for less major ones like vegetables, fruits, etc., may not, to a large extent, enter into the picture at all. Such under-estimates and suppression of figures are not expected to be present or, if present, it will be minimal—in the data for the extent of cultivated land under the various food crops but figures for yield will suffer from the same handicap. Yields are usually given not in absolute figures but as a range between two figures, the average of which may be expected to reflect the yield in a large area in the State. Instead of employing the mean of this range, the adoption of the lower figures of yield worked out by the official agricultural experts would help in arriving at a safe and conservative estimate. This method may often err, but it will be comforting to know that it errs only on the safer side. Hence, it was adopted in the present estimate in preference to the other two methods outlined above. It was also felt that this method will introduce fallacies to a minimum extent.

The recent publication of the revised and enlarged edition of Wood's "Agricultural Facts and Figures" (1952) by the Madras Government prompted the present attempt to assess the food situation in the composite State of Madras. Such appraisal is desirable in view of the statements often made, sometimes alarming, about the food situation in the Madras State. In the present computation, it should be distinctly understood that the figures relate to a normal year without the visitations of such abnormalities as floods, drought, etc. Even so, the figures are to be considered only as approximations likely to be of help in shaping future agricultural policies. An assumption has been made that imports and exports of food, into and from the State, are considered negligible and may neutralize one another, and hence, do not seriously vitiate the calculations. This assumption may not be justifiable in the case of pulses, for which there is a fairly large scale import into the State. Even so, the overall intake of food will not be seriously altered. Further, these assumptions would appear extraneous to a study confined to the actual food production in the State.

The acreage under various food crops and figures for yields employed in the present computation of agricultural production are given in Table I. Assuming that the available food were equitably distributed among the entire population, the food available per 'consumption unit' per day was calculated and is also shown in Table I. In this calculation it was felt that data per 'consumption unit' would be more useful than the corresponding figures per head of the population. In the conversion of population figures into 'consumption units', various ratios have been

suggested based on the age structure of population revealed by census data and the respective calorie coefficients of the age-structure. Mitra (1952) has worked out that a population of 10,000 would be equivalent to 7,310·5 'consumption units' or roughly 0·73 'consumption unit' per head of population. This ratio has been held by many to be too low; a critical assessment by others has shown that a figure of 0·80 per head of population would be a more reasonable one and hence this was adopted in the present calculations. The population of the Madras State is about 54 millions. The total 'consumption units' in the State would then work out on this basis to 43·2 millions.

It is also relevant to mention the following additional details which have a bearing on the construction of Table I.

Cereals: Though about a dozen cereals are stated to be grown and consumed in the Madras State, only the more important nine of them have been included in the table. Figures for acreage for the common millet (*Panicum miliaceum*), Sanwa millet (*Echinochloa frumentacea*) and Korali (*Setaria glauca*) are not available. Further their production and consumption may be expected to be relatively small and are hence not included. Their non-inclusion will be in accordance with the general aim of maintaining the estimate of production on a conservative basis.

Pulses: Only the major five have been included, omitting the relatively minor ones like field bean (*Dolichos lablab*), Cowpea (*Vigna ungiuculata*), soya beans (*Glycine max*), Pillipesara (*Phaseolus trilobus*), *Phaseolus sublobatus* and dew gram (*Phaseolus aconitifolius*).

Nuts and Oilseeds: The three major edible oilseeds, groundnut (*Arachis hypogea*), gingelly (*Sesamum indicum*) and coconut (*Cocos nucifera*) are only taken into consideration. It is presumed that the production and consumption of other nuts and oilseeds are not substantial enough to make any tangible contribution to food intake.

Condiments and spices: Though a large number of condiments and spices are produced and consumed in the state, account has been taken of only three of them chillies, onions and turmeric, which are produced in fair quantities. Though figures for the extent of cultivation in the State and yields are available for an additonal dozen or so condiments and spices, they are not included in the construction of the table as being inconsequential.

Fruits: Quite a large variety is grown and consumed, but for most of them, data are scanty. Some are too expensive to merit consideration in population-production data. Some are prolific yielders like the Jack (*Artocarpus integra*), pine apple, citrus fruits, guava, papaya, etc., and being not so expensive may contribute in a small measure to the total

food intake. But, the absence of data on their production and consumption in the State precludes their inclusion in the present calculations. Only the two major fruits, cheap and relatively abundant, mango and banana (which includes the plantain) are taken into account. The non-inclusion of others, particularly the citrus fruits, will help maintaining a conservative estimate of fruit production and consumption.

Vegetables: Though a variety of vegetables are grown and consumed, authentic data are lacking for most of them. Being a tropical country with luxuriant vegetation, it is to be expected that a large number of them would be extensively grown and consumed. But diet surveys do not reveal a liberal consumption of vegetables by the bulk of the population. No record is available of the vegetables grown in many kitchen gardens and consumed both in the rural and urban areas. Any guess about their production and consumption would be so wide off the mark that it would be safe to omit them in the calculations of food intake. Data relating to two of the root vegetables, potato and tapioca, are, however, available and are included in the table.

Milk: Various estimate and 'guestimates' of milk production and consumption in the State are available. Most of them are in the neighbourhood of 3·5 oz. per head per day, all of which is not consumed as fluid milk. A fair proportion is used for the manufacture of butter and ghee. Hence, this figure of 3·5 oz. per head per day may be assumed to be the intake of a 'consumption unit'. This would allow for the consumption of butter-milk, some of which may be distributed free in establishments employing large herds of milch cattle or in creameries where butter is manufactured.

Other Foodstuffs: No account has been taken of the consumption of meat and eggs. While the majority of the population is non-vegetarian by faith, the economic situation is such as to preclude any large scale consumption of these articles of food. Data on their consumption are woefully lacking; where some figures were obtained as a result of detailed and pains-taking diet surveys, it was found that they were consumed in insignificant amounts. In an earlier computation it was found that the consumption of meat (including eggs) and fish in the Madras State amounted to only 0·133 and 0·29 Oz. respectively per "Consumption Unit" per day.* Figures for consumption of meat and fish today may not be expected to be very different. Any increase in production might have been offset by increased population. In view of this small intake, the nutrients furnished by them are not reckoned in the construction of Tables I and II.

* W. R. Aykroyd (1937): League of Nations Health Organization, C. H. 1253 (C) No. 2.

Betel leaves: The production and consumption of betel leaves deserve special mention. It is stated that 28,769 acres in the state are devoted to the cultivation of betel vine. It is a prolific yielder, giving an average of about 80 lacs of leaves per acre per annum. Even on a most conservating reckoning of 16 leaves to an ounce, the production and consumption of betel leaves is something quite significant. Little wonder then that the habit of chewing betel leaves smeared with slaked lime is wide spread. The ingestion of calcium through this means may be appreciable but as the amounts could not be correctly guessed, they have been omitted from the calculations of nutrient intake. An additional reason for omitting the calcium intake by this means is that betel-chewing is often accompanied by chewing of tobacoo when salivation induced by the betel leaves and tobacco is mostly spit out and not taken in. There will then be no addition to calcium intake. Such a habit is prevalent only amongst the men-folk whereas the women, not normally addicted to tobacco chewing, consume in entirety the betel leaves smeared with slaked lime. With the latter, the addition to calcium intake by this means may be significant.

Table II gives the individual nutrients available per 'consumption unit' — protein, fat, carbohydrate, calcium, phosphorus, iron, thiamine, niacin and riboflavin — from the various foodstuffs as also the calorific value furnished by them. Figures for vitamin A activity and vitamin C have not been worked out, because production and consumption of even small quantities of leafy vegetables, and sometimes fruits too, would significantly inflate these figures.

Table III gives a consolidated statement of the various nutrients available per 'consumption unit'.

In working out the figures shown in Tables II and III, the analytical data given in Health Bulletin No. 23 (1951) were employed. The following assumptions have also been made. The chemical composition of rice has been calculated on the basis that the entire consumption of rice is in the raw, milled state. While it is obvious that rice is also consumed in its other states, viz., undermilled, parboiled, handpounded, etc., they have not been taken into account in these calculations as data on the amount of rice consumed in the different states are not available and as the aim of the present study is to obtain a conservative estimate; raw milled rice has a smaller content of most nutrients than other varieties of rice and hence its composition was employed for the construction of Table II.

In computing the nutrients furnished by the three oilseeds and nuts, it has been assumed that 90 per cent groundnut and coconut are crushed for converting into oil and only 10 per cent consumed per se. In

the case of gingelly seeds, the entire production has been assumed to be utilized for conversion into oil. These assumptions are, undoubtedly, arbitrary, as no authentic data exist on the relative proportions of the oilseeds and nuts used for expression of oil and those used for direct consumption. However, it is presumed that the assumptions made would not be far removed from practices obtaining in the homes representing the different socio-economic strata in the Madras State.

The composition of foodstuffs given in Health Bulletin No. 23 represents percentages of the edible portion. Allowance should, therefore, be made for the wastage or non-edible portion, especially when the latter is present in significant proportions. The non-edible portion is not considerable with most of the items reckoned in Table II except in the case of the two fruits, mango and banana, which contain about 25 and 40 per cent respectively. Hence, the gross production figures for mangoes and banana have been converted into net values, representing the edible portion only. In the case of the coconut, production figures have been worked out on the basis of kernel weight only and not on the whole nut which will have considerable non-edible portion.

Discussion: It will be seen from the data in Tables II and III that the diet available for the population of the Madras State appears to be *quantitatively* adequate, supplying as it does 2,641 calories per 'consumption unit' against a recommended allowance of 2,600 calories for an adult employed in moderate activities. It does not allow sufficient margin for seed requirements and for the inevitable wastage during transit, distribution, cooking losses, etc. From the point of view of *quality*, the diet is somewhat defective, as nearly two-thirds of the total calories are furnished by cereals alone. The diet is over-weighted with carbohydrates which contribute about 70 per cent of the total calories. The protein content of the diet is somewhat low and could with advantage be increased by 25 to 30 per cent. The amount of animal protein available is very low and might profitably be bettered. Likewise, the amount of animal fat available for consumption could be increased, though the overall picture regarding availability of fat is not unsatisfactory. To effect these improvements, an increased production and consumption of milk, meat, fish and egg is desirable. With a long coastline, it should not be difficult to increase the intake of fish by those who have no religious objection to partaking of it.

The minerals available from the diet, calcium, phosphorus and iron, may be stated to be adequate except perhaps in the case of calcium. When this is considered in conjunction with the widespread habit of chewing of betel leaves smeared with slaked lime, notwithstanding its limitations, and the consumption of some leafy vegetables, the calcium requirements of the population may be deemed to have been fairly

adequately met. As much as 28,769 acres are devoted to the cultivation of betel vine, producing over 4,00,000 tons of leaves rich in calcium, carotene and vitamin C. In addition to its being inherently rich in calcium, liberal amounts are employed for smearing the leaves, thus contributing substantially to total calcium intake, more especially in the case of those not addicted to chewing tobacco in addition. Calcium ingested through this means is physiologically available. Further, the intake of most vegetables, including leafy vegetables, has not been taken into considerarion, for lack of data. The leafy vegetables being rich in calcium and iron would make some contribution to total intake of these two elements. The intake of the cheap and easily cultivated leafy vegetables may with advantage be increased.

The amount of vitamins furnished by the diet is in general inadequate, more especially in vitamins of the B-group. The latter should nearly be doubled for ensuring satisfactory intakes, preferably by increased production and consumption of pulses. The supply of vitamins A and C has not been considered at all, as it is inextricably mixed up with the production and consumption of leafy vegetables and fruits, rich sources of carotene (pro-vitamin A) and vitamin C.

Notwithstanding these seeming deficiencies, the overall impression left in the mind after a critical appraisal is that the food situation in the Madras State is not so pessimistic or grave as is often made out in the lay press and elsewhere. Yet, it is definitely on the marginal side, allowing little or no provision for lean years and for natural calamities like drought, floods, etc., or for the inevitable inequalities of distribution. The food situation could and should be improved if the entire population were to be fed at nutritionally adequate levels. There is hardly room for complacency; in fact, complacency would be dangerous, especially in the context of the steadily growing population pressure.

TABLE I.

	Acreage (1,000 acres)	Annual yield per acre	Total annual production (million tons)	Available food per "consumption unit" per day (in ounces)
Cereals:				
Rice ..	10,500	1,000 lbs.	4·690	10·806
Sorghum ..	4,828	400 ,,	0·862	1·987
Cumbu ..	2,597	300 ,,	0·350	0·806
Ragi ..	1,748	1,000 ,,	0·780	1·797
Italian millet ..	1,543	600 ,,	0·413	0·952
Kodo millet ..	987	600 ,,	0·264	0·608
Samai ..	565	400 ,,	0·101	0·233
Wheat ..	12	400 ,,	0·002	0·005
Maize ..	58	1,200 ,,	0·031	0·070
	22,838		7 493	

	Acreage (1,000 acres)	Annual yield per acre	Total annual production (million tons)	Available food per "consumption unit" per day (in ounces)
Pulses:				
Red gram ..	337	900 ,,	0·1354	0·312
Horse gram ..	1,549	350 ,,	0·2420	0·557
Green gram ..	506	320 ,,	0·0723	0·167
Black gram ..	292	320 ,,	0 0417	0·096
Bengal gram ..	65	550 ,,	0·0160	0·037
	2,749		0·5074	
Oilseeds and Nuts:				
Groundnut ..	3,743	900 ,,	1·5040	3·466
Gingelly seeds ..	718	100 ,,	0·0321	0·074
Coconut ..	606	1,500 ,, (of kernel)	0·4058	0 935
	5,067		1·9419	
Condiments and Spices:				
Chillies (dry) ..	289·0	1,200 lbs.	0·1549	0·356
Onions ..	43·69	9,000 ,,	0·1756	0·405
Turmeric (dry) ..	33·642	4,000 ,,	0·0601	0·139
			0·3906	
Sugar and Jaggery:	203·0	6,000 ,, (jaggery)	0·5438	1·254
Vegetables:				
Potato ..	14·997	12,000 ,,	0·0804	0·185
Tapioca ..	25·475	6,000 ,,	0·0670	0·155
			0·1474	
Fruits:				
Mangoes ..	250·0	12,500 ,, (gross) and	1·3890 (gross) 1·0420 (net)	2·401
Bananas (including plantain) ..	150·0	15,000 ,, (gross) and	1·0000 (gross) 0·6000 (net)	1·382
Milk:	—	—	—	3·5
Betel leaves:	28·769	31,250 ,,	0·4013	0·926

TABLE II.

	Per cons. unit	Protein	Fat	Carbohy-drate	Ca.	P.	Fe.	Thiamine Int.	Nicotinic acid	Ribo-flavin	Calories
	Oz.	g.	g.	g.	mg.	mg.	mg.	Units	mg.	g.	
Cereals:											
Rice ..	10·806	21·61	1·08	237·74	32·42	335·00	3·24	64·84	3·24	248·55	1,069·84
Sorghum ..	1·987	5·96	0·99	41·73	15·90	156·98	3·57	65·58	0·99	206·66	200·71
Cumbu ..	0·806	2·66	1·13	15·41	11·29	79·85	2·50	25·00	0·72	—	82·27
Ragi ..	1·797	3·59	0·72	39·00	168·95	138·40	2·69	71·89	0·54	—	176·14
Italian Millet ..	0·952	3·33	1·24	16·37	7·61	78·06	1·71	52·36	0·19	—	90·43
Kodo Millet ..	0·608	1·46	0·24	5·23	6·08	42·59	0·91	18·86	—	—	52·93
Samai ..	0·233	0·51	0·31	4·22	1·40	23·33	0·46	6·54	—	—	21·70
Wheat ..	0·005	0·02	0·002	0·09	0·06	0·42	0·006	0·23	0·006	0·16	0·45
Maize ..	0·07	0·23	0·07	1·34	0·21	6·63	0·05	—	0·03	2·0	6·92
	17·265										1,701·39
Pulses:											
Red gram. ..	0·312	1·96	0·16	5·06	12·48	21·84	0·78	13·42	0·22	44·31	29·64
Horse gram ..	0·557	3·51	0·06	9·03	44·60	61·32	1·17	—	0·22	—	50·73
Green gram ..	0·167	1·13	0·06	2·68	6·67	13·33	0·40	7·33	0·10	18·33	15·83
Black gram ..	0·096	0·66	0·04	1·65	5·78	9·63	0·27	3·85	0·06	10·31	9·54
Bengal gram ..	0·037	0·18	0·06	0·65	2·00	2·52	0·10	1·04	0·03	5·39	3·81
Oilseeds:											
Groundnut ..	3·466	2·63	3·92	2·01	4·85	38·09	0·18	88.65	1·39	29·44	54·02
		(1/10)	35·25								317·27
Gingelly ..	0·074		0·91	—	—	—	—	—	—	—	8·17
Coconut ...	0·935	0·13	1·10	0·34	0·28	6·36	0·05	0·37	0·02	2·62	11·79
		(1/10)	9·94								89·42

TABLE II *(Contd.)*

	Per cons. unit Oz.	Protein g.	Fat g.	Carbohy-drate g.	Ca. mg.	P. mg.	Fe. mg.	Thiamine Int. Units	Nicotinic acid mg.	Ribo-flavin g.	Calories
Condiments:											
Chillies (dry) ..	0·356	1·60	0·64	3·20	16·04	35·65	0·25	—	—	—	24·96
Onions ..	0·405	0·20	0·04	1·50	4·05	8·09	0·12	4 45	0·04	1·21	6·88
Turmeric (dry) ..	0·139	0·25	0·19	2·73	5·97	11·11	0·73	—	0·09	—	13·75
Sugar and Jaggery ..	1·254	—	—	35·60	—	—	—	—	—	—	142·42
Vegetables:											
Potato ..	0·185	0·09	0·02	1·20	0·60	1·67	0·04	1·11	0·06	0·60	5·18
Tapioca ..	0·155	0·03	0·02	1·68	1·55	1·55	0·03	0·62	0·02	4·33	6·95
Fruits:											
Mangoes ..	2·401	0·48	0 24	7·93	7·20	14·41	0 24	—	0·24	33·61	33·61
Bananas ..	1·382	0·42	0·14	9·68	4·12	11·06	0·14	—	0·14	66·36	41·44
Miscellaneous: ..											
Milk ..	3·5	3·15	3·50	4·90	119·00	87·50	0·35	17·50	0·35	199·50	63·00
Betel leaves ..	0·926	0·83	0·18	1·57	60·19	10·19	1·48	—	0·18	8·33	11·11
Total ..		56·62	62·252	452·54	538 30	1,196·58	21·466	443·64	8·876	881·71	2,640·91

TABLE III.

Showing available nutrients per "consumption unit" per day.

Protein	..	56·62 g.
Fat	..	62·25 g.
Carbohydrate	..	452·54 g.
Calcium (Ca)	..	538·30 mg.
Phosphorus (P)	..	1,196·58 mg.
Iron (Fe)	..	21·47 mg.
Thiamine	..	443·64 Int. Units.
Nicotinic acid	..	8·88 mg.
Riboflavin	..	881·71 mg.
Calories	..	2,640·91

Research Note

Variations of Soil Temperature at Coimbatore

Soil temperature has an important part to play in the maintenance of moisture status in the soil. Optimum level of moisture in the soil is very essential for successful crop production. Roots and shoots of plants depend on soil-moisture for their normal development.

To gain an idea of the variations of soil temperature due to depths and seasons, the soil thermogragh charts pertaining to the depths of 4″, 6″ and 24″, maintained for a period of nine years, were examined and relevant data for intervals of two hours were culled out. The soil is of light black colour, best suited for the cultivation of cotton under irrigated conditions. Twelve sets of data were collected for each depth, each set comprising a period of nine years. Fisher's analysis of variance was used to study the variations in hourly and weekly temperature. By students 't' test the significance of the difference between the means at 4″, 6″ and 24″ depths, taken in pairs, was tested. Finally by calculating the correlation coefficients of mean temperatures at these three depths, the degree of association was assessed.

Tentative Findings: (i) The soil temperature is maximum at the period 12–16 hours. There is no significant difference in the temperatures noted in this period.

(ii) The soil temperature is minimum at 4-8 hours. The difference in the temperatures observed in this period is also not significant.

(iii) The weekly fluctuations of the soil temperature are significant.

(iv) The dispersion of temperature round the mean at 4″ depth is greater than the same at the two successive bottom depths, namely, 6″ and 24″.

(v) The soil temperature at 4″ depth is significantly greater than the temperature at 24″ depth $\left(\frac{x}{\sigma} = 2{\cdot}665\right)$. The difference between the temperatures at 4″ and 6″ depths is not statistically significant.

(vi) The coefficient of variability is greatest for the temperature at 4″ depth and it gradually decreases as the depth increases.

(vii) A very high positive correlation exists between the temperatures recorded at 4″ and 6″ depths ($\gamma = +0{\cdot}9126$). The correlations between the temperatures at 6″ and 24″ ($\gamma = +0{\cdot}7968$). and 4″ and 24″ ($\gamma = +0{\cdot}8239$), depths are also positive and significant. But the degree of relationship is less pronounced in the latter two cases.

Acknowledgment: The authors are grateful to Sri P. A. Venkateswara Iyer, Agronomist and Professor of Agriculture, for his valuable guidance in the preparation of this note. Their thanks are also due to all those who have been responsible for the maintenance of charts and also to Kumari T. P. Anna for her assistance in the compilation and computation of the data.

Rajagopalan N. Proc., 22nd Indian Sci. Cong. 1935, P. 352; Ramdas L. A. and David R. K. 1934 Curr. Sci. *3*.

Agricultural Meteorology Section, Coimbatore, Dated 20—2—1954.

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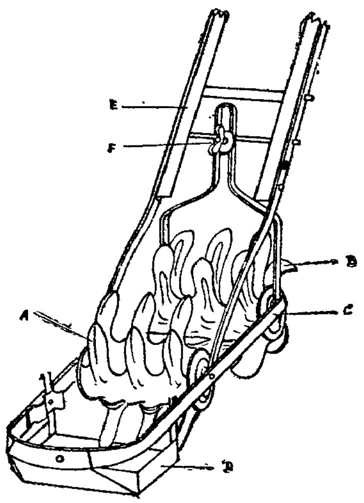
The Japanese Type Rotary Weeder

The Japanese rotary type weeder is a simple implement capable of being handled by one man and used for interculturing in paddy-fields where the seedlings are sown in rows 10″ apart. The implement thoroughly loosens soil in between the rows, and pulls out and buries the weeds. It can cover an area of 60 to 75 cents in a day of 8 hours and does not impose any undue strain on the operator. This weeder approximately weighs 11 lb. and cost Rs. 35/- to manufacture.



A. Front weeding drum
B. Rear weeding drum with back swept fingers
C. Frame work
D. Float
E. Handle
E. Adjustment for hight

The rotary weeder consists of two weeding drums each made up of 6 sets of 3 sheet metal fingers. The drums are each $4\frac{1}{2}''$ long and $7''$ dia Weeding drums of greater or lesser width can be used where the spacing between rows is greater or lesser than $10''$. The two drums are mounted one behind the other $10''$ apart on a sheet metal frame work $5\frac{1}{2}''$ wide and $20''$ long. The fingers of the forward drum loosen the soil and pull out the weeds and the fingers of the other which are swept back slightly at the tip churn up the soil and bury the weeds. A boat shaped float $5\frac{1}{2}''$ wide $6\frac{1}{2}''$ long is attached to the frame work in front of the leading drum. This float guides the implement over the loose soil and prevents it from sinking unduly. The frame work is attached to a wooden handle and the angle between the handle and frame work is capable of adjustment to suit the convenience of the operator. The implement is pushed forward and pulled backward alternately by the operator, as he walks along in the space between the two rows. The weight of the implement is sufficient to obtain the necessary penetration and no downward thrust should be applied on the handle during the push and the pull, lest the rear drum should sink too deep and the implement should get bogged. With a little practice the correct technique is easily acquired.

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Note:- "Experiments are under way to determine the value of weeding and interculture in different areas and seasons. Till the results of these experiments are available, the department is not in a position to recommend this operation or an implement for the operation. The Rotary Weeder mentioned in the article may be useful to those who wish to weed their paddy crop, besides being of help in the conduct of trials in our Agricultural Research Stations." (Ed.)

EXTRACTS AND GLEANINGS

Trashy leaf Tobacco: Trashy leaf results from the curing of leaf abnormally low in hexose sugars and high nitrogen. Its occurrence may be reduced by cultural practices which restore a favourable balance of carbohydrates and nitrogen in the plant. The affected leaf is brown in colour, has either a papery or hard brittle texture, and is lighter in weight than normal leaf. The transition from trashy to good leaf is gradual, producing various gradations of trashiness. Severely affected leaf is unsuitable for the manufacture of tobacco and represents a total loss to the grower.

Recent research has shown that trashy leaf is not due to disease, insect pests, or faulty technique in harvesting and curing, but rather to a abnormal chemical consitution brought about by unfavourable climate and cultural conditions. At the green stage trashy leaf is difficult to distingush in appearance from normal leaf. It is only on curing that the typical colour and texture of the trashy leaf develop. The investigation was facilitated when it was found that potentially trashy and normal uncured leaf differ in appearance under ultra-violet light. The underside of uncured quickly-dried leaves high in carbohydrates and low in nitrogen glows (fluoresces) strongly when exposed in the dark to ultra-violet light. On the other hand, potentially trashy leaf, low in carbohydrate and high in nitrogen, fluoresces only feebly or not at all. Leaves of intermediate composition exhibit an intermediate degree of fluorescence. Thus the degree of fluorescence in uncured tobacco leaves is a most useful measure of potential quality. In the uncured state trashy leaf is characterized by an extremely low sugar content and a relatively high nitrogen level. During the curing process the deficieny of sugars leads to an undesirable breakdown of the tissues, with a loss of yellow pigments.

Some types of leaf low in sugars and high in nitrogen yield, on curing, a thin, papery, brown-coloured, trashy leaf consisting mainly of cell-wall material which has paper-like smoking qualities without any specific odour. Other types, especially those very high in nitrogenous compounds, produce a thick horny leaf harsh to the touch with brown to reddish areas. Often, on smoking, such leaf gives objectionable odours reminiscent of burnt wool or meat. It is much disliked by manufacturers as it imparts undesirable odours even when present in very small proportions. The incorrect but prevalent belief that over-ripening and or over-curing have caused trashiness has led to under-curing and harvesting of immature leaf. The resulting leaf has a strong green cast and is generally also low in carbohydrate and high in nitrogen.

While nitrogen is available the plant continues to absorb it, and this may lead to the production of leaf with high nitrogen content and a low sugar-nitrogen ratio or in other words, to the production of non-cigarette leaf. From the point of view of leaf quality a deficiency of nitrogen is to be preferred to an excess, and the ideal situation is one in which there is ample nitrogen during the growing period with a deficiency just prior to harvesting. In this respect, nitrogen fertilizers should be used judiciously and only enough applied to ensure satisfactory growth. If side dressings are necessary during growth the fertilizer should be in a readily assimilable form, be quickly available to the plant, and be depleted before the harvest.

Shading tends to lower the carbohydrate level, since it reduces photosynthesis. In a shading experiment in north Queensland the leaves of plants exposed to direct sunlight contained nearly three times as much carbohydrate and three-fifth the amount of nitrogen as plants covered to simulate field shading

On curing, the shaded leaves were trashy but those exposed to direct sunlight produced good cigarette tobacco.

Shading may be minimized in the field by planting the rows wherever possible in an east-west direction and by placing the plants as far apart as other agronomic requirements allow. Low topping is suggested as a further means of reducing shading and it also prevents the transport of sugars to the apex at the critical period.

In general, lack of balance of nutrients and deficiency or excess of major trace elements have immediate adverse effect on the leafy part of the plant. The necessity for constant access to water is evident as, quite apart from general physiological disorganization, the effect of prolonged drought on plants is impoverishment in carbohydrates and accumulation of nitrogen. (Agricultural News Letters, Australia, Release No. AGN/539.)

The chemical method of caponisation (by injecting the hormone Stilboestrol) produced birds equal in growth and quality with birds which had been surgically caponised. There is some gain by the chemical method of caponiszation in that (a) there is less likelihood of losses which may occur when birds are surgically caponised, and (b) there is no check or setback for birds which are chemically caponised. The effect of injecting stilboestrol tablets becomes obvious within the first month after the injection.

There is a significant difference in the quality of the carcass of a capon and that of a cockerel, both in market appearance when it is killed and plucked and also in palatability when it is cooked and eaten.

Australorp x. White Léghorn cockerels, if caponised, reach their prime for marketing and palatability as capons at from 21 to 22 weeks of age when treatment with stilboestrol is started at 10 weeks of age. (New Zealand Journal of Agriculture, Vol. 88, No. I, 1954.) (T. R. N.)

CROP AND TRADE REPORTS

Crop Statistics, Madras State, 1953—'54. Blackgram — First and Final forecast: The area sown in the Madras State upto 25th December, 1953 is estimated at 141,000 acres and shows an increase of 2·0% over previous year and a decrease of 6·2% on the previous five years. The increase in area this year is due to timely rains at the time of sowing. The crop is mainly grown in the districts of Tiruchirapalli, Tanjore, Madurai, Tirunelveli, Malabar and South Kanara. A decrease in area is estimated in the districts of Tiruchirapalli and Madurai and an increase in the other districts of the State. The crop has been harvested in some districts of the State. The crop is reported to have been affected to some extent in South Kanara district for want of moisture in the soil. The yield per acre is expected to be normal in the district of Salem, Coimbatore and Tanjore and slightly below the normal in the other districts of the State. The seasonal factor for the State as a whole works out to 96% of the normal as against 81% estimated for the previous year. On this basis, the total yield works out to 14,500 tons of cleaned grain giving an increase of 20·8% and 14·2% respectively over previous year and average yield. The average wholesale prices of dhall per maund of 82$\frac{2}{7}$ lb. on 9th January 1954 at important market centres, compared with the prices which prevailed in the corresponding period of last year show a decrease of 2·2 per cent in Tirunelveli.

Greengram — First and Final forecast: The area sown in the Madras State upto 25th December 1953 is estimated at 127,100 acres showing an increase by 4·2 % over last year a decrease of 0·2 % compared with previous five years. The crop is mainly grown in the districts of Coimbatore, Tanjore and Tirunelveli. An increase in area is estimated in all the districts of the State, except in the districts of Chingleput, Tiruchirapalli, Tirunelveli, and South Kanara where the area was the same as that of last year. The crop has been harvested in some districts of the State. The crop is reported to have been affected by inadequate moisture in the soil in the district of South Kanara. The yield per acre is expected to be normal in the districts of Salem and Coimbatore and slightly below the normal in the other districts of the State. The Seasonal Factor for the State as a whole works out to 96 % of the normal as against 85 % of the normal for the previous year. On this basis, the total yield works out to 10,000 tons of cleaned gram giving an increase by 17·4% over last year and compared with the average yield for the five years ending with 1951—52, an increase by 14·8%. The average wholesale price of dhall per maund of 82$\frac{2}{7}$ lb. on the 9th January 1954 was Rs. 20—1—0 in Salem.

Horsegram — First and Final Forecast: The area sown in the Madras State upto 25th December 1953, is estimated at 553,200 acres, showing an increase of 4·7% over last year and 5·9% over the previous five years. The increase in acreage under the crop is due to timely rains received at the time of sowing. An increase in area is estimated in all the districts of the State except Tanjore, and Malabar where the area was the same as that of last year. The crop is reported to have been affected by want of moisture in the soil in the districts of Malabar and South Kanara. The yield per acre is estimated to be normal in the districts of Salem, Coimbatore, Tiruchirapalli and Tanjore, and slightly below the normal in the other districts of the State. The Seasonal Factor for the State as a whole works out to 98 % of the normal as against 76 % of the normal estimated for the previous year. On this basis the yield works out to 48,700 tons and compared with last year and the average yield for the previous five years, shows an increase of 35·7% and 48·5% respectively.

Bengal gram — Second Forecast Report: The area sown in the Madras State upto the end of February 1954 is estimated at 5,200 acres and compared with previous year and average area for the five years ending with 1952—'53, shows an increase of 15·6% and a decrease of 1·9% respectively. The increase in area in the current year is attributed to timely rains at the time of sowings. The crop is not grown in the districts of Chingleput, Tanjore, Malabar, South Kanara and the Nilgiris. An increase in area is estimated in the districts of South Arcot, Salem, Coimbatore and Ramanathapuram and the area was the same as that of last year in the districts of North Arcot, Tiruchirapalli, Madurai and Tirunelvelly. The condition of the crop is generally satisfactory in all the districts of the State. The yield per acre is expected to be normal in the districts of South Arcot, Salem and Ramanathapuram. The condition of the crop is generally satisfactory in all the districts of the State. The yield per acre is expected to be normal in the districts of South Arcot, Salem and Ramanathapuram. The Seasonal Factor for the State as a whole works out to 98 % of the normal as against 71 % for the corresponding period of the previous year. On this basis the total yield works out to 1100 tons and compared with the estimated production of the previous year and an average estimated production for the five years ending 1952—'53 shows an increase of 83·3% and 22·2% respectively. The wholesale prices of dhall per maund of 82$\frac{2}{7}$ lb. or 3200 tolas for the week ending 6th March 1954 compared with the price which prevailed in the corresponding period of the previous year, in Salem, shows a decrease of 305 %.

Gingelly — Final Forecast Report: The area sown in the Madras State in 1953—'54 is estimated at 421,500 acres and compared with the final area for 1952—'53, shows an increase of 41·0% with the average area for the five years ending with 1952—'53 an increase of 18·8%. The increase in area this year is mainly due to favourable seasonal condition. A decrease in area is estimated in the districts of South Arcot, Tirunelveli, and Malabar and an increase in the other districts of the State except in South Kanara where the area estimated is the same as that of last year. The crop is reported to have been affected by insect pest and excessive rains in the district of Tirunelveli. The yield per acre is estimated to be higher than that of last year in all the districts of the State. The Seasonal factor for the State as a whole works out to 96 % of the normal as against 78% of the normal estimated for the previous year. On this basis, thetotal yield works out to 52,500 tons representating an increase of 75·6% over the previous year and yield of 41·1% over the previous five years. The wholesale price per standard maund of 82$\frac{2}{7}$ lb. or 3,200 tolas as reported from important market centres compared with the prices which prevailed on 11th April 1953 show a decrease of 16·5% in Tiruchirapalli, 13·0% in Tirunelveli, 10·0 % in Tuticorin and 3·1 percent in Salem. (Director of Statistics, Madras).

Weather Review — For the month of May, 1954.

RAINFALL DATA (IN INCHES)

Division	Station	Total for the month	Departure from normal	Total since 1st January	Division	Station	Total for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·0	— 1·0	2·9	South	Madurai	4·9	+ 2·2	11·7
	Tirurkuppam*	0·0	— 2·2	3·1		Pamban	1·4	+ 0·4	11·7
	Vellore	2·6	+ 0·3	5·6		Koilpatti*	7·8	+ 5·6	18·2
	Gudiyatham*	1·7	— 1·0	5·1		Palayamcottai	1·1	— 0·5	10·5
East Coast	Palur*	0·1	— 1·9	7·4		Ambasamudram*	0 2	— 1·6	18·5
	Tindivanam*	0·0	— 1·2	8·1	West Coast	Trivandrum	5·9	— 2·9	22·4
	Cuddalore	0·2	— 0·8	14·3		Fort Cochin	14·4	+ 2·7	28·1
	Nagapattinam	0·1	— 1·5	6·6		Kozhikode	12·6	+ 3·7	20·3
	Aduturai*	0·9	— 0·8	7·9		Pattambi*	1·5	— 4·4	9·1
	Pattukottai*	3·1	+ 1·9	14·9		Taliparamba*	7·7	+ 0·9	12·3
Central	Salem	2·9	— 1·7	5·9		Wynaad*	5·4	+ 0·4	10·1
	Coimbatore (A. M. O.)*	3·6	+ 1·7	10·4		Nileshwar*	4·0	— 2·2	14·3
	Coimbatore	3·6	+ 1·1	14·2		Pilicode*	4·0	— 1·4	13·6
	Tiruchirapalli	5·3	+ 2·7	11·2		Mangalore	5·7	— 2·0	10·4
						Kankanady*	3·5	— 2·3	8·5
					Hills	Kodaikanal	6·9	+ 0·5	25·1
						Coonoor*	4·9	+ 1·6	27·9
						Ootacamund*	3·9	— 0·8	11·7
						Nanjanad*	3·1	— 1·2	9·6

Note:—1. * Meteorological Stations of the Madras Agric. Dept.

Conditions were markedly unsettled in the north Andaman Sea on the first day of the month. They concentrated into a depression in about two days and passed away north-eastwards to the coast of Burma. The unsettled conditions, which again appeared in the east central Bay of Bengal on 6 – 5 – 1954 persisted for two days and became unimportant on 8 – 5 – 1954. A feeble advance of the monsoon occurred in the south Andaman Sea on 15 – 5 – 1954. The conditions were slightly unsettled in the east central Bay of Bengal on 17 – 5 – 1954. The monsoon continued to be weak in the south Andaman Sea upto 21 – 5 – 1954 and thereafter conditions were favourable for the advance of the monsoon into the south-east Bay of Bengal. A trough of low pressure formed in the east Arabian Sea off the Kanara–Konkan Coast on 23 – 5 – 1954 but got filled up in two days. The monsoon strengthened in the Andaman Sea on 28 – 5 – 1954 and advanced into the southeast and east central Bay of Bengal, where the conditions were markedly unsettled. A trough of low pressure favourable for the advance of the monsoon, but became less again appeared off the Malabar–Kanara Coast on 29 – 5 – 1954, marked on the following day. The monsoon advanced over Travancore–Cochin as a feeble current on 31 – 5 – 1954. A series of six western disturbances passed over the extreme north of the country during this month. Thundershowers were fairly well distributed in Tamil Nad, Malabar and south Kanara. The note-worthy rainfalls and the Zonal rainfall for the month are furnished hereunder.

Note-worthy Rainfalls for the Month

Date	Name of Place	Rain-fall	Name of Zone	Av. rain-fall for April	Dep. from normal	Remarks
1/5/54	Fort Cochin	3·72″	North	1·08	— 1·00	Below normal
,,	Trivandrum	2·54″	East Coast	0·73	— 0·72	,,
5/5/54	Koilpatti	2·33″	Central	3·85	+ 0·95	Above normal
13/5/54	Nileshwar	2·28″	South	3·08	+ 1·22	,,
23/5/54	Kodaikanal	2·48″	West Coast	6·47	— 3·01	Below normal
24/5/54	Pattukottai	2·23″	Hills	4·70	Nil	Normal

Agricultural Meteorology Section
Lawley Road P. O.,
Coimbatore, 11—6—1954

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Tranfers

Anantanarayanan, K. P., Lec. in Entomology, Coimbatore, Government Entomologist, Coimbatore; Doraiswami, S. V., Asst. Marketing Officer, Madras, Officer for conducting the survey of the Economics of the Farm Management; Ekambaram, C., On leave, Supdt. Sugarcane Liaison Farm, Nellikuppam; Ganesamurthy, N., A. D. Coimbatore, Addl. D. A. O. Pattukottai; Kanakaraj David, S., Asst. in Entomology, Coimbatore, Lec. in Entomology Coimbatore; Krishnamurthy, R., On leave, Addl. D. A. O. Madurai; Masilamani, B. P., S. D. A. Madurai, Spl. D. A. O. Madurai; Mukundan, M., Supdt. A. R. S. Wynad, Training Supdt. Coimbatore; Nambiar, P. K., Training Supdt. Taliparamba; Ramaswami Iyer, K., Supdt. Central Farm Coimbatore, Training Supdt. Coimbatore; Sahadevan, P., Asst. in Paddy, Taliparamba, S. D. O. Vellore; Subramania Chetty, M., Training Supdt. Pattukottai; Santhanam, K., Spl. D. A. O. Madurai, Training Supdt. Kalluppaty; Thomas, K. C., S. D. A. Shoranur, Addl. D. A. O. Tanjore; Uthaman, P., S. D. O. Vellore, Supdt. A. R. S. Palur; Vaidyanathan, M. Spl. D. A. O. Tanjore, Training Supdt. Koilpatty; Venkatakrishnan, G., Training Supdt. Aduturai.

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Announcement

RAMASASTRULU MUNAGALA PRIZE COMPETITION

The last date of submission of essays has been extended upto 31st July 1954.